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That I am knowledgeable in the English language and the Japanese language and that I believe the hereto attached English translation is a true and complete translation of the officially certified copy of Japanese Patent Application No. 2000-142063 filed May 15, 2000, submitted on April 26, 2001 in connection with the United States Patent Application Serial Number 09/842,051 filed April 26, 2001.

I hereby declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Application Number: Patent Application Number 2000-142063

Applicant(s): THE YOKOHAMA RUBBER CO., LTD.

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[Matter] SPECIFICATION 1

[Matter] DRAWINGS 1

[Matter] ABSTRACT 1

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[Document] SPECIFICATION

[Title of the Invention] GOLF CLUB HEAD

[Claims]

[Claim 1] A golf club head having a face with a surface comprising an upper half portion and a lower half portion with the position of a sweet spot as boundary between them, which have a roll radius of 305 mm or below and 310 mm or above respectively.

[Claim 2] A golf club head as claimed in Claim 1, wherein while the upper half portion comprises a curved surface, the lower half portion comprises a flat surface.

[Detailed Description of the Invention]

[0001]

[Field of Art of the Invention]

The present invention relates to a golf club head imparted with a curvature on the surface of its face, and more particularly, a golf club head with which a loss of the carry can be prevented from occurring when the launching angle is reduced and inconstant carries can be suppressed if the ball striking point is not constant in the up and down direction on the club face.

[0002]

[Conventional Art]

Generally, the club faces of wood-type golf club heads are imparted on their surfaces with a curvature called a roll in up and down direction of the club head (or vertically when the golf club is held in position at the starting of ball striking). Normally, the roll radius is constant over a whole area of the club face surface.

[0003]

With a golf club head imparted on its face surface with a curvature of a constant roll radius as above, the substantive loft angle in a lower portion of the face surface below its central part is relatively limited, so that a difficulty is posed that if hit at

such lower portion, the ball cannot be lofted as desired, resulting in a loss of the carry. Further, when the ball striking point is on the lower side of the club face as above, while the initial velocity of the ball is slightly accelerated in that the face surface is imparted with a roll, that the launching angle is limited is more influential upon the carry than that the initial velocity of the ball is increased.

[0004]

Also, in the case of the club head under reference, now that the carry tends to be insufficient when the ball is hit on a lower side point on the face, a problem is likely that when the ball striking point is not constant in the up and down direction on the club face, the carry tends to be inconstant considerably.

[0005]

[Subject for Intended Solution by the Invention]

Objects of the present invention center upon the provision of a golf club head with which, when a ball is hit on a lower side on the club face, a loss of the carry can be prevented from taking place even when the launching angle is relatively small and, at the same time, inconstant carries can be suppressed even when the ball striking point may not be constant in the up and down direction on the club face.

[0006]

[Means for Attaining the Subject]

The golf club head for attaining the above object according to the present invention is characterized in that an upper half portion and a lower half portion of the surface of its face with the position of its sweet spot as boundary between such portions are imparted with a roll of a radius of 305 mm or below and 310 mm or above, respectively.

[0007]

The roll radius in a lower side portion of the club face surface below the sweet

spot is set to be relatively large or the curvature in such club face surface portion is set to be relatively small as above, and thereby the substantive loft angle at a lower ball striking point is increased and the launching angle is increased, so that the loss of the carry likely when the ball is hit at a lower striking point can be suppressed. Also, now that the loss of the carry at the lower ball striking point can be limited as above, inconstant carries likely when the ball striking point is not constant in the up and down direction on the club face can be suppressed.

[0008]

In or for the present invention, it may be designed that while the upper half portion of the club face comprises a curved surface based on the described roll radius, the lower half portion has an infinitely enlarged roll radius and comprises a flat surface.

[0009]

Further, the herein termed sweet spot refers to the point at which a perpendicular drawn in imagination in the direction of from the center of gravity of the club head to the face surface and the face surface cross each other, and it is located in the vicinity of the center of the face surface.

[0010]

[Mode of Carrying Out the Invention]

Now, with reference to the appended drawings, a description in greater detail will be entered into the constitution of the present invention.

[0011]

Fig. 1 and Fig. 2 of the appended drawings show a wood-type golf club head according to a mode of carrying out the invention. In the drawings, the golf club head indicated at 1 has a hollow structure formed with a face 2 on its front side and is made of a metallic material such as titanium, stainless steel and aluminum. The golf club head 1 comprises a tubular hosel part 3 integrally provided on the side of a heel thereof, and

is made to be joined with a shaft S through the hosel part 3. The face 2 may be provided on its surface with scores 4 of any optional pattern.

[0012]

As shown in Fig. 1, it is designed that a sweet spot SS is formed at the position at which a perpendicular V drawn in imagination in the direction of from the position of the center of gravity of the club head to the surface of the face 2 and the surface of the face 2 cross each other. An upper half portion 2a and a lower half portion 2b of the surface of face 2 with the position of the sweet spot SS as boundary between the two portions are respectively imparted with a roll of a radius R_1 and a radius R_2 which are set to be 305 mm or below and 310 mm or above respectively. In the present embodiment of the invention, while the upper half portion 2a of the face 2 comprises a curved surface based on the above roll radius R_1 , the lower half portion 2b comprises a flat surface with the radius R_2 enlarged infinitely.

[0013]

With the described golf club head, while the roll radius R_1 of the upper half portion 2a of the surface of face 2 is set to be relatively small, the roll radius R_2 of the lower half portion 2b is set to be relatively large as above, so that in hitting a ball in the lower half portion 2b it is possible to obtain a large substantive loft angle and a large launching angle. As a result of the above, the loss of the carry at a low ball striking point can be suppressed. In addition, attributable to that the loss of the carry at a low ball striking point is suppressed, inconstant carries when the ball striking point is inconstant in the up and down direction on the face can be suppressed.

[0014]

In or for the present invention, it is required to meet that while the roll radius R_1 of the upper half portion 2a of the surface of face 2 is 305 mm or below, that R_2 of the lower half portion 2b is 310 mm or above. If the roll radius R_1 of the upper half portion

2a exceeds 305 mm, the carry at a high ball striking point tends to lower, while the carry at a low ball striking point tends to be insufficient when the roll radius R_2 of the lower half portion 2b is smaller than 310 mm. More preferably, further, the roll radius R_1 of the upper half portion 2a should be set at 260 mm or below, of which the lower limit value should be 152 mm preferably.

[0015]

Further, although the description of a mode of carrying out the invention is made in the above in connection with a wood-type golf club head, it is also possible to apply the present invention to iron-type golf club heads, in the case of which, too, a same effect or result can be brought about as in the case of wood-type golf club heads.

[0016]

[Example and Comparative Examples]

There were provided a golf club head of an Example according to the present invention and golf club heads of Comparative Examples 1 to 4 having a variety of face configurations.

[0017]

Comparative Example 1:

The face surface was imparted with a curvature of a roll radius R which was constant over a whole surface area of the face and was set at 203 mm.

[0018]

Comparative Example 2:

The face surface was imparted with a curvature of a roll radius R which was constant over a whole surface area of the face and was set at 254 mm.

[0019]

Comparative Example 3:

The face surface was imparted with a curvature of a roll radius R which was

constant over a whole surface area of the face and was set at 305 mm.

[0020]

Comparative Example 4:

The face comprised a flat surface (with no curvature imparted).

[0021]

Example:

With the position of the sweet spot as boundary of an upper half portion and a lower half portion of the face, the face was made comprising a compound surface such that while the upper half portion comprised a curved surface having a roll radius R of 203 mm, the lower half portion comprised a flat surface.

[0022]

Golf clubs were provided by setting the golf club heads of the Comparative Examples 1-4 and of the Example respectively to a shaft, and with use of a swing robot ("Shot Robot" produced by Miyamae), measurements of the carry were carried out under the condition of a head speed of 40m/s and with the ball striking point variously diversified. Results of the measurements are shown in Table 1 below.

[0023]

Measurements of the carry were made five times for each point of ball striking on the club head, and an average of the values found (m) of each golf club was taken for evaluation. The ball striking point on the club head was shifted in the up and down direction from the position of the sweet spot and is shown in the Table 1 by the distance (mm) from the sweet spot. While negative values refer to ball striking points on the side below the sweet spot, the positive values do to ball striking points on the side above the sweet spot.

[0024]

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Table 1 (Results of Carry Measurements)

Launching Points (positions above or below sweet spot (mm))	-15	-10	-5	0	5	10	15
Comparative Example 1 (R=203 mm) (m)	144.3	172.5	180.4	185.5	186.7	186.0	182.7
Comparative Example 2 (R=254 mm) (m)	150.0	175.1	181.3	184.9	185.4	183.8	184.5
Comparative Example 3 (R=305 mm) (m)	155.3	176.3	182.2	185.0	184.4	181.9	178.1
Comparative Example 4 (no curvature) (m)	174.2	182.5	184.8	183.6	178.0	168.7	165.9
Example 1 (complex curvature) (m)	174.1	182.4	184.2	184.1	186.5	185.4	181.9

[0025]

As seen from the above Table 1, with the golf club heads of Comparative Examples 1-3 of which the roll radius of the face surface is 305 mm or below, while the carry at a ball striking point above the sweet spot was relatively large, that at a ball striking point on the side below the sweet spot was relatively small. Also, with the golf club head of Comparative Example 4 of which the face comprised a flat surface, while the carry at a ball striking point on the side below the sweet spot was relatively large, that at a ball striking point on the side above the sweet spot was relatively small.

[0026]

In contrast to the above, with the golf club head of the Example of which while the roll radius R_1 of the upper half portion of the face surface was relatively limited, the

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lower half portion was made a flat surface, the carry was relatively large at each of a ball striking point above the sweet spot and a one below the sweet spot. In other words, stable carries were attained irrespective of differences in the ball striking point in the up and down direction on the club face.

[0027]

[Effect/Result of the Invention]

As described above, it is devised that with the position of the sweet spot as boundary between an upper half portion and a lower half portion of the club face surface, the upper half portion has a roll radius of 305 mm or below, while the lower half portion has a roll radius of 310 mm, whereby a loss of the carry likely when the launching angle is reduced when a golf ball is hit at a lower side of the club face can be prevented from occurring and, at the same time, inconstant carries likely due to a difference in the ball striking point in the up and down direction on the face surface can be suppressed.

[Brief Description of the Drawings]

[Fig. 1]

A side elevational view, showing a golf club head according to a mode of carrying out the present invention.

[Fig. 2]

A perspective view of the golf club head according to the mode of carrying out the present invention.

[Explanation of Reference Symbols]

- 1: golf club head;
- 2: (club) face;
- 2a: upper half portion;
- 2b: lower half portion;
- 3: hosel part;

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4: scores;

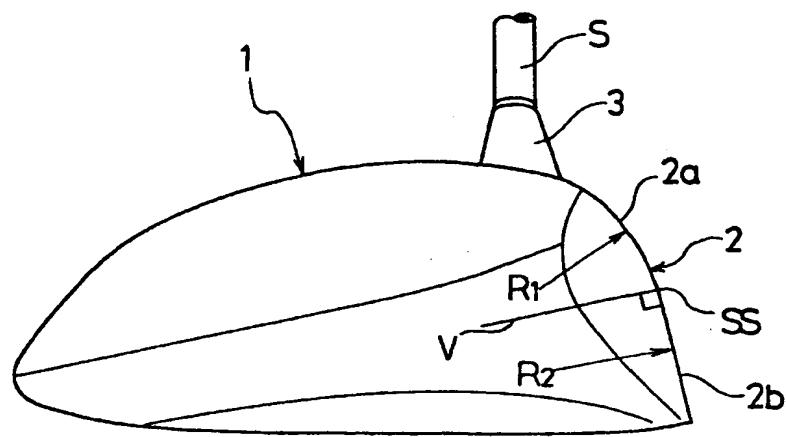
SS: sweet spot.



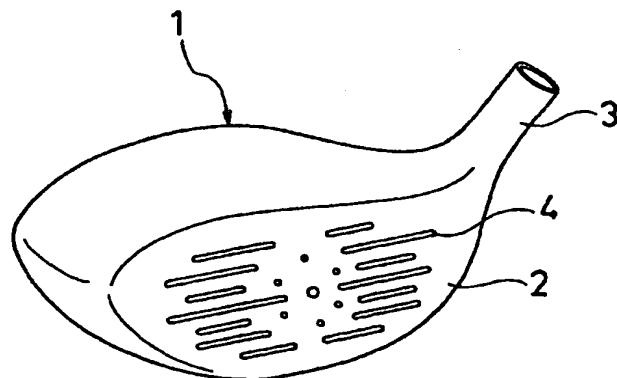
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[Document] DRAWINGS

[Fig. 1]



[Fig. 2]



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[Document] ABSTRACT

[Abstract]

[Subject] To provide a golf club head with which a loss of the carry likely when the launching angle is reduced when a golf ball is hit at a lower side of the club face is prevented from occurring and, at the same time, inconstant carries likely due to a difference in the launching point in the up and down direction on the face is suppressed.

[Means for Attainment] With the position of sweet spot SS as boundary between an upper half portion 2a and a lower half portion 2b of a face 2 of a golf club head, it is designed that while the upper half portion 2a has a roll radius R_1 of 305 mm or below, the lower half portion 2b has a roll radius R_2 of 310 mm or above.

[Elected Drawing Figure] Fig. 1